Claims

1. Apparatus for detecting the oscillation amplitude of an oscillating object, the apparatus comprising an optical radiation source; a detector comprising first and second optical radiation sensing areas adjacent each other, the detector and the optical radiation source adapted to be located opposite each other with the oscillating object located between the source and the detector so that the object blocks a portion of the sensing areas from receiving optical radiation from the source; and a processor coupled to the detector to receive first and second output signals representing the magnitude of optical radiation sensed by the first and second optical radiation sensing areas, respectively; the processor processing the first and second output signals to obtain an indication of the amplitude of oscillation of the object.

2. Apparatus according to claim 1, wherein the processor generates an output oscillation signal that is applied to the oscillating object to modify the oscillation amplitude of the object in response to the oscillation amplitude indicated by the processor.

3. Apparatus according to claim 2, wherein the output oscillation signal is input to a control device that controls oscillation of the object.

4. Apparatus according to claim 3, wherein the control device compares the oscillation amplitude with a reference value and controls the oscillation of the object so that the object oscillates at an amplitude substantially equal to the reference value.

5. Apparatus according to claim 3 or claim 4, wherein the oscillation amplitude is controlled in real time.

6. Apparatus according to any of claims 1 to 5, wherein the width of each of the first and second optical radiation sensing areas is greater than the sum of half the width of the oscillating object and the amplitude of oscillation of the object.

7. Apparatus according to any of the preceding claims, wherein the first and second optical radiation sensing areas are directed towards the optical radiation source.

8. Apparatus according to any of claims 1 to 6, wherein the first and second optical radiation sensing areas are not directed towards the optical radiation source and the detector further comprises an optical device to direct the optical radiation onto the first and second sensing areas.

9. Apparatus according to claim 7, wherein the first and second optical radiation sensing areas are adjacent each other.

10. Apparatus according to any of the preceding claims, wherein the oscillating object is a tip of an ultrasonic transducer for use in an ultrasonic welding machine.

11. A wire bonder comprising apparatus according to any of claims 1 to 9.

12. A wire bonder according to claim 11 when dependent on any of claims 3 to 5 or on any of claims 6 to 10 when dependent on any of claims 3 to 5, wherein the control device comprises an ultrasonic wave controller.

13. A method of detecting the oscillation amplitude of an oscillating object, the method comprising positioning an optical radiation source and an optical radiation detector on opposite sides of the object, the detector comprising first and second optical radiation sensing areas; illuminating the object with optical radiation from the source and processing first and second output signals from the first and the second optical radiation sensing areas to determine the oscillation amplitude of the object.

14. A method according to claim 13, wherein the first and second output signals are processed by comparing the sum of the first and second output signals with the difference between the first and second output signals.

15. A method according to claim 13 or claim 14, wherein the oscillating object is a tip of an ultrasonic transducer in an ultrasonic welding machine.

16. A method according to any of claims 13 to 15, further comprising controlling the oscillation amplitude of the oscillating object in response to the determined oscillation amplitude.

17. A method according to claim 16, wherein the oscillation amplitude is controlled by comparing the determined oscillation amplitude with a reference value and controlling the oscillation of the object to oscillate at an amplitude substantially equal to the reference value.

18. A method according to claim 16 or claim 17, wherein the oscillation amplitude is controlled in real time.

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